

Notes - Composition of Functions

$$[f \circ g](x) = f[g(x)] \quad | \quad [g \circ f](x) = g[f(x)]$$

Plugging a whole function into the x-values of the other function.

Ex: $f(x) = 2x^2 + 3x$ $g(x) = x - 4$

1) $[f \circ g](x) = f[g(x)] = f(x-4)$

$$2(x-4)^2 + 3(x-4)$$

$$2(x-4)(x-4) + 3x - 12$$

$$2(x^2 - 8x + 16) + 3x - 12$$

$$2x^2 - 16x + 32 + 3x - 12 = \boxed{2x^2 - 13x + 20}$$

2) $[g \circ f](x) = g[f(x)] = g(2x^2 + 3x)$
 $(2x^2 + 3x) - 4$

3) $[g \circ f](3) = g[f(3)]$

Option 1: $[g \circ f](x)$ first then plug in #

$$2(3)^2 + 3(3) - 4 = \textcircled{23}$$

Option 2: Plug # into inside function first
Then plug your answer into outside function

$$f(3) = 2(3)^2 + 3(3) = 27$$

$$\downarrow$$
$$g(27) = 27 - 4 = \textcircled{23}$$

CW. 1/22

1) $g(x) = x+5$ $h(x) = x^2+6$

A. $[g(h(x))] = g(x^2+6) = x^2+6+5 = \boxed{x^2+11}$

B. $[h \circ g](x) = h(x+5) = (x+5)^2+6 = x^2+10x+25+6 = \boxed{x^2+10x+31}$

C. $g[h(-3)] = (-3)^2+11 = 9+11 = \boxed{20}$

2) $g(x) = 3x^2-5x+2$ $l(x) = 2x-1$

A. $[l \circ g](x) = 2(3x^2-5x+2) - 1 = 6x^2-10x+4-1 = 6x^2-10x+3$

B. $[g(l(10))]$

$l(10) = 2(10)-1 = 19$
 $g(19) = 3(19)^2-5(19)+2 = 990$

HW: P. 387 # 29-41 odd